

Higginsville, Missouri
Water Supply Study
City Lake

Higginsville Lake is in Lafayette County Missouri.

Higginsville water supply comes from a city owned lake located about 2 miles east of Higginsville on a tributary to Davis Creek.

When lake levels reach three feet below the spillway, water is pumped from the Missouri River into the lake. When the water level in the lake reaches about 10 inches below the spillway, they cease pumping.

Average annual rainfall is 37.2 inches. Annual rainfall for 1953 through 1957 is 24.1, 33.6, 39.4, 25.59, and 47.1 inches.

Higginsville Lake analysis consisted of using the NRCS's computer program "RESOP". This program analyses remaining stored water at the end of each month by summing gains and losses.

Four analysis were made:

1. First run was the entire demand was taken from the lake. This resulted in an extended period of water shortage.
2. The lake was analyzed for the optimum daily use without emptying the lake during the evaluation period.
3. The existing plan of operation to maintain an adequate level of water in the lake.
4. A Plan was determined that shared distributing the supply in the lake and pumping from the Missouri River, not allowing the lake to completely dry up.

There are two lakes, a small one immediately upstream of the larger water supply lake. It is very shallow and is used for sediment detention. The main effect of the small lake is water lost to evaporation. Spillage from the upper lake flows into the large lake.

The drainage area of the upper lake is 2.70 square miles.
The drainage area of the lower lake is 2.66 square miles.
Total drainage area of the two lakes is 5.36 square miles.

In 2001 Higginsville used an average use of 0.956 million gallon of water per day. The lake would only Supply an average of 0.456 million gallon per day.

Following are considerations for data input to the "RESOP" program.

STO-AREA Elevation-Storage and Elevation-Area data were determined from June 25, 2002 survey made by USGS. There are two lakes in series. The upper lake is small and overflow spills into the lower lake.

Higginsville water supply lake

Elevation (feet)	Area (acres)	Storage (ac-ft)
736	3.3	1.8
738	14.0	18.4
740	30.4	62.3
742	47.2	139.8
744	67.8	254.8
746	83.9	407.5
748	98.6	589.9

Upper Lake

Elevation (feet)	Area (acres)	Storage (ac-ft)
758	9.1	4.3
760	22.4	37.7
762	32.2	94.1
* 762.8	34.5	120.8
** 763	34.9	127.7
* Water Surface on 6/24/2002		
** Spillway Elevation (Full Pool)		

750	114.8	803.1	
752	129.3	1048.1	
754	140.8	1318.1	
754.7	145.2	1418.1	Water Surface on 6/25/2002
755	147.1	1462.0	Spillway Elevation (Full Pool)

LIMITS Full Pool storage 1462 Ac.Ft.
Minimum Pool storage 50 Ac.Ft.

Starting storage was considered at full pool.

GENERAL The adjustment factor of 0.76 to convert from pan evaporation to lake evaporation was applied prior to entering the data for the control word EVAP. As a result a factor of 100 is used.

The record period of drought is in the 1950's. Analysis began in Jan. 1951 and ended December 1959.

SEEPAGE The reservoir seepage varied from 0 seepage near empty to a maximum of 2.0 inches per month at full pool. The seepage rate is a best estimate based on history of the reservoir, soil type, material of the core of the dam and compaction of the earth fill. The material in the dam is compacted earth of clayey soils.

RAINFALL Rainfall data is used to determine the amount of rainfall on the lake. The long-term gage at Lexington, Missouri was used.

RUNOFF This is the runoff into the lake from its drainage area. Monthly runoff volumes in Watershed inches were determined and comparisons were made for the Blackwater River Gage at Blue Lick, South Fork Blackwater River near Elm and Shiloh Creek gage near Marshall. The three gages yielded similar monthly runoff volumes with Shiloh Creek being the highest. However The Shiloh creek drainage has a higher percentage of cropland than the other gages and also Higginsville lake. The Blackwater River Gage was used for 1951 to June 1954, when data from South Fork Blackwater River near Elm became available which was used to complete the study. The drainage area at the South Fork gage is 16.6 square miles.

The South Fork Blackwater River gage is located Northwest of Warrensburg. The soils and land use in the drainage area of the gage and the lake are similar.

In cases where rainfall to runoff values did not appear reasonable, adjustments were made for that month by looking at individual rains and estimating antecedent moisture and then, adjusting runoff based on NRCS's runoff curve numbers.

EVAP. Pan evaporation at the Lakeside gaging station was used as a base because it has data for year around evaporation. All other stations only measure data between April through November. Lakeside data was updated during these months with gage data from stations at New Franklin, and Columbia. Depending on the latest data for the station nearest to Higginsville.

DEMAND This was determined by city records. In Year 2001 Higginsville used 348,980,000 gallons. The average daily use is 956,110 gallons per day.

OTHER Other refers to water gained or lost from other sources, in this case it is the amount of water pumped to the reservoir from the Missouri River.

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Storage Volume

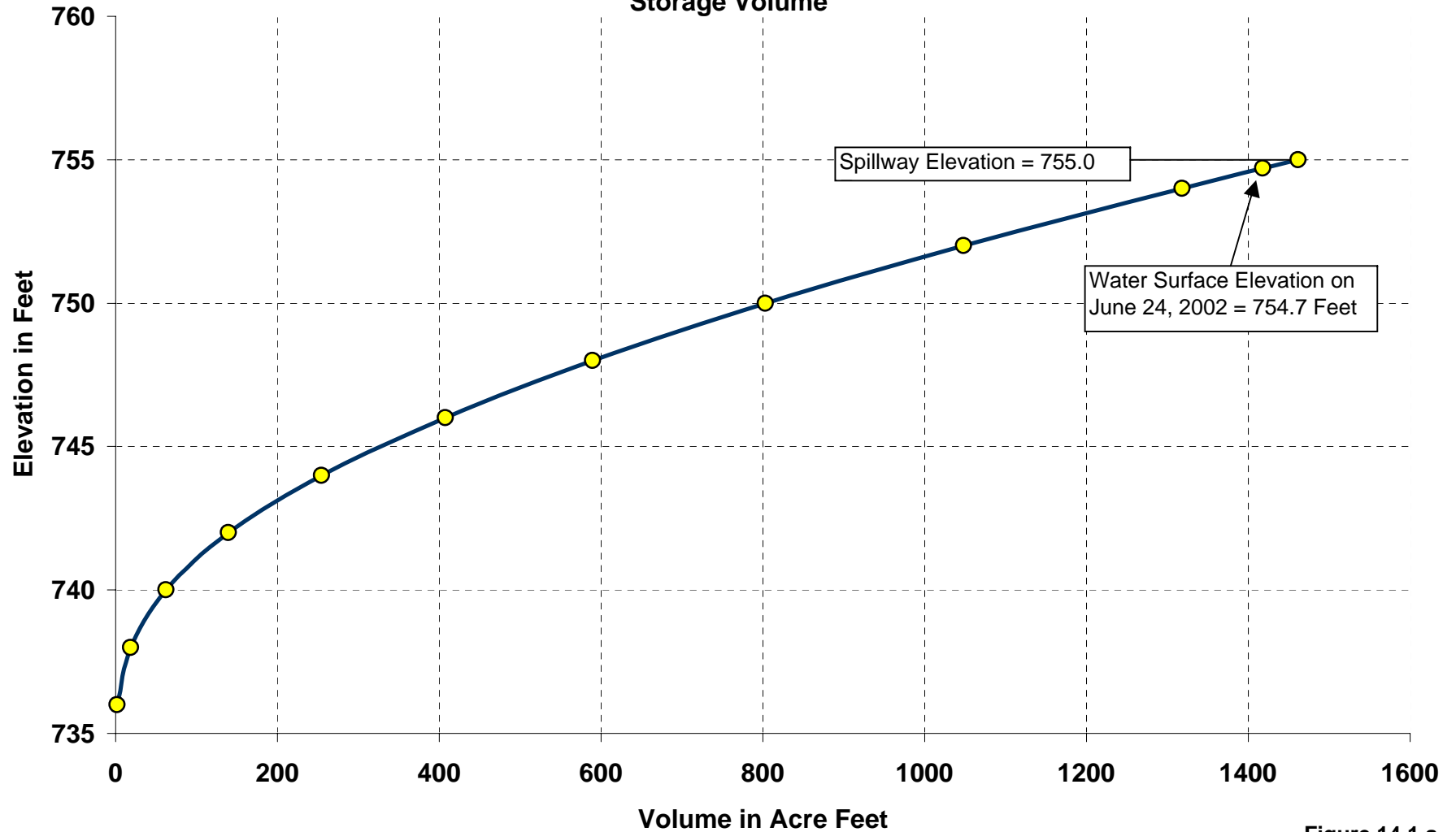


Figure 14.1.a

Higginsville, Missouri

Water Supply Study

City Lake

Surface Area

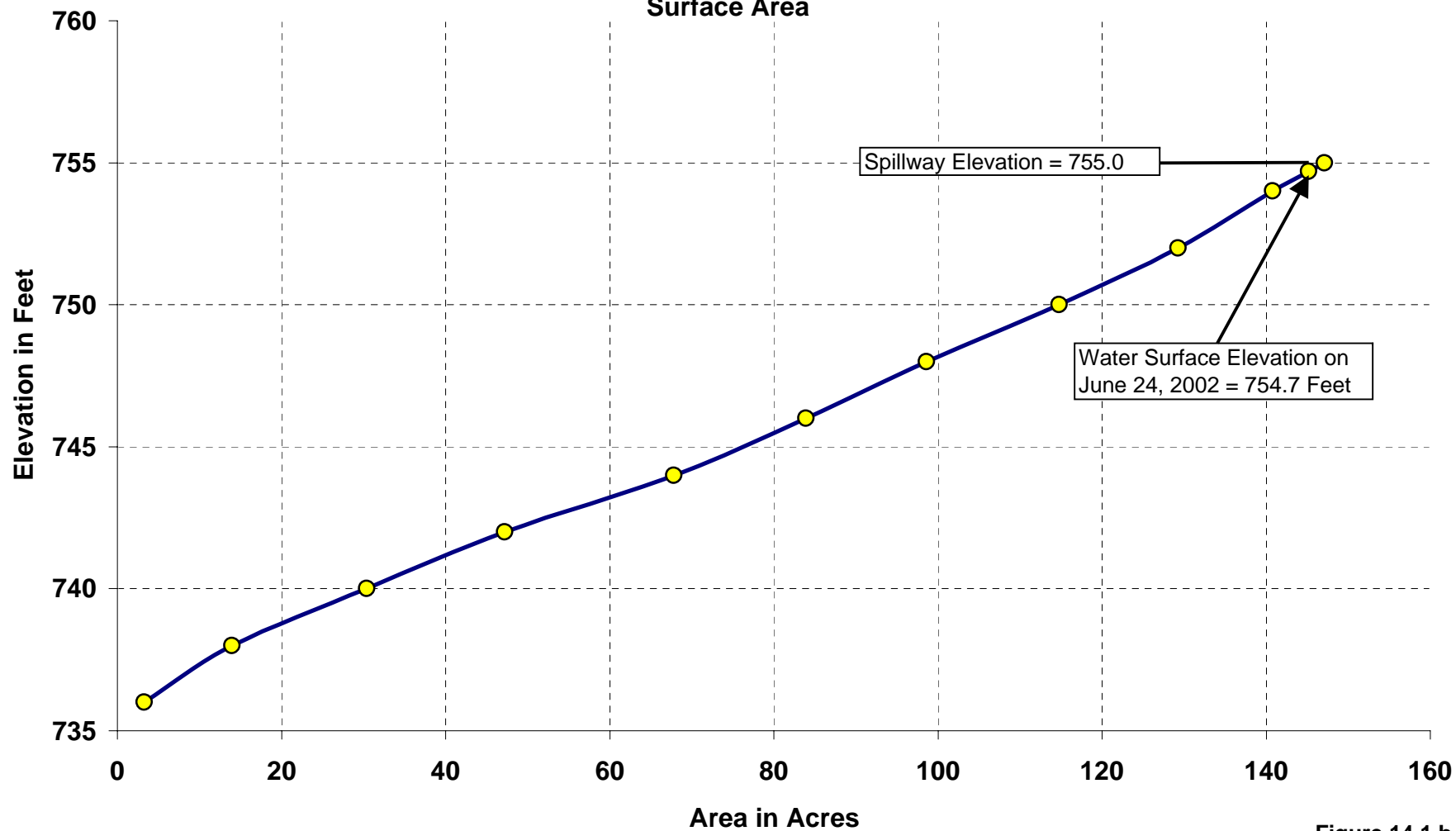


Figure 14.1.b

Higginsville, Missouri
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Sediment Control Pond
Storage Volume and Surface Area

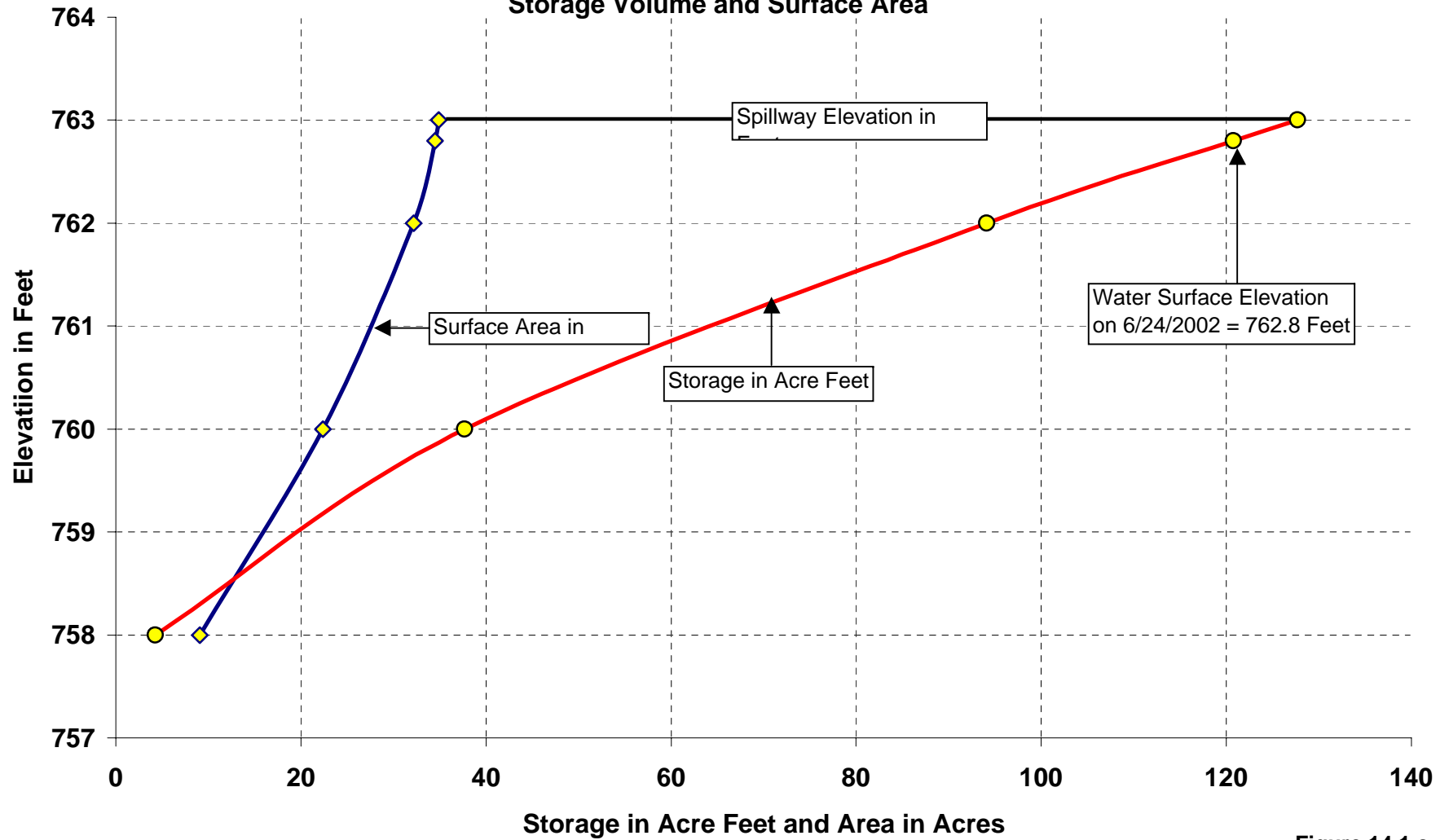


Figure 14.1.c

Higginsville, Missouri

Water Supply Study

City Lake

Lake Storage

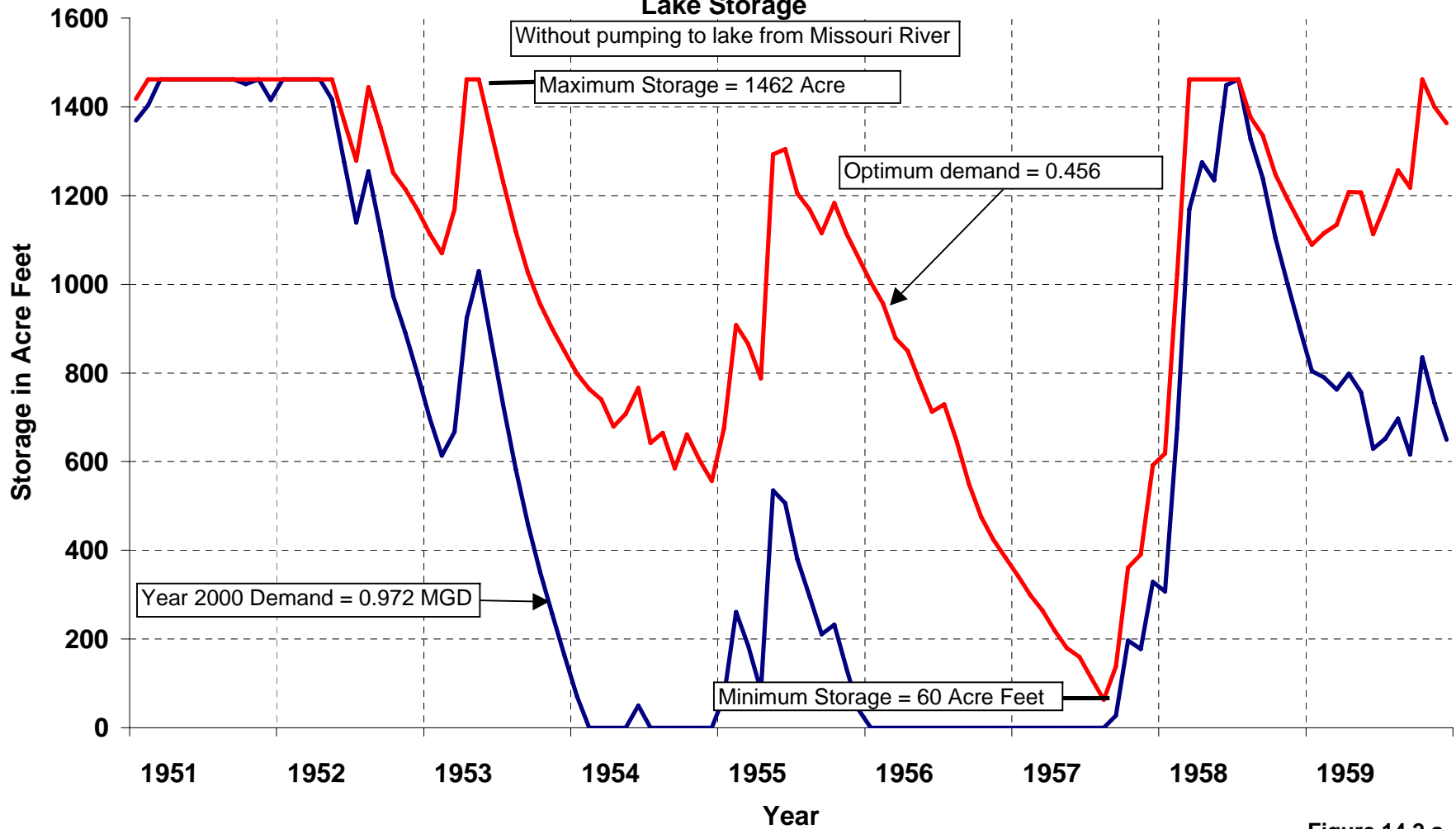


Figure 14.2.a

Higginsville, Missouri

Water Supply Study

City Lake

Lake Storage

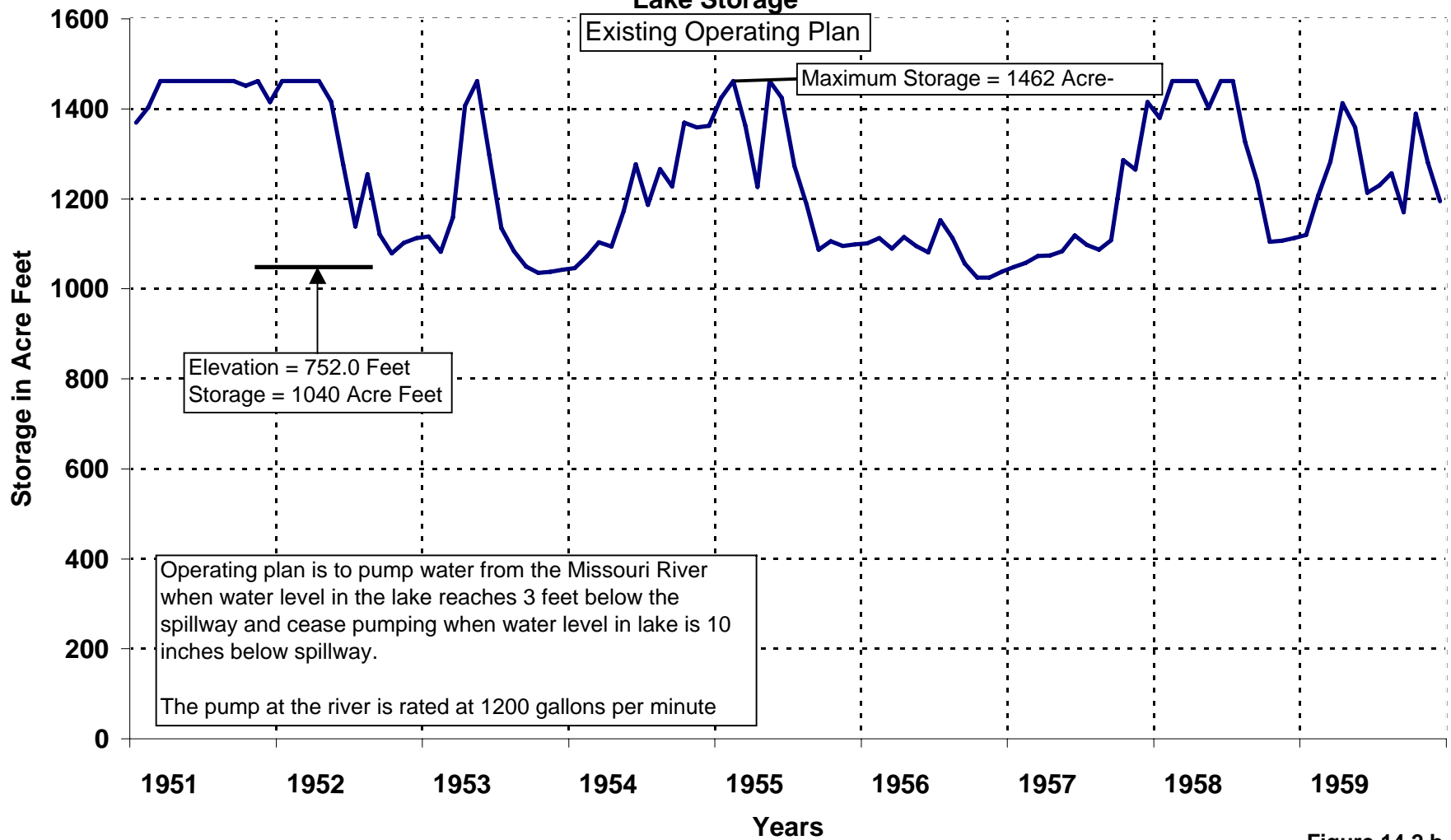


Figure 14.2.b

Higginsville, Missouri

Demand in Million Gallon per Day

Water use

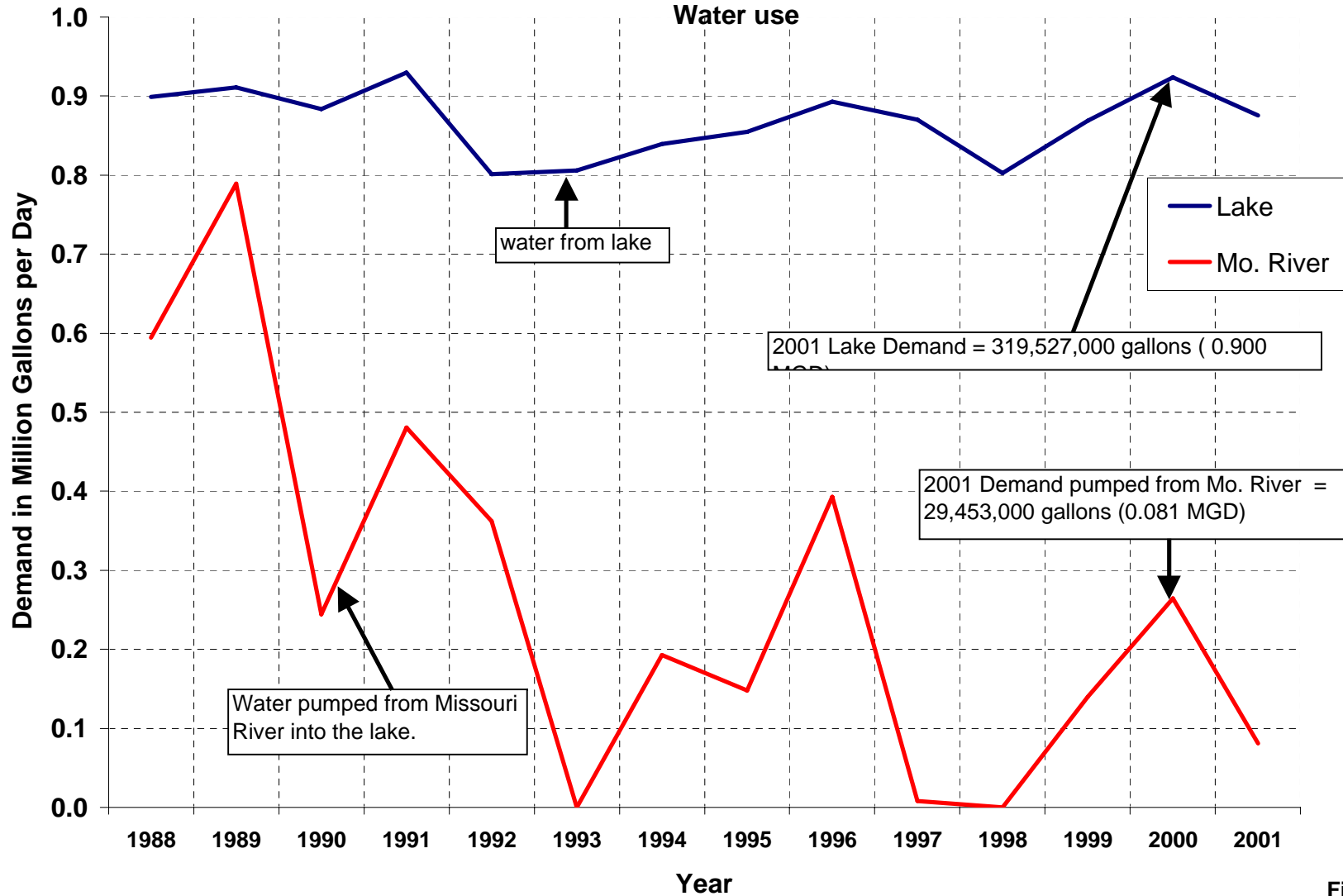


Figure 14.3

HIGGINSVILLE LAKE

EXPLANATION

— 760 — BATHYMETRIC CONTOUR—Shows altitude of the reservoir bottom. Contour interval 2 feet. Datum is sea level.

—762.8— WATER SURFACE—Shows elevation of water surface, June 24-25, 2002 (table 19). Datum is sea level.

⊠ U. S. GEOLOGICAL SURVEY REFERENCE MARKER—Chiseled square on left overflow of upper concrete spillway. Elevation 763.0 feet. Datum is sea level.

⊡ U. S. GEOLOGICAL SURVEY REFERENCE MARKER—Chiseled arrow on second pier of water house walkway on upstream side. Elevation 758.3 feet. Datum is sea level.

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FEET

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METERS

Elevation (feet)	Area (acres)	Volume (acre-ft)
Upper Lake		
758.0	9.1	4.3
760.0	22.4	37.7
762.0	32.2	94.1
762.8	34.5	120.8
763.0	34.9	127.7
Lower Lake		
736.0	3.3	1.8
738.0	14.0	18.4
740.0	30.4	62.3
742.0	47.2	139.8
744.0	67.8	254.8
746.0	83.9	407.5
748.0	98.6	589.9
750.0	114.8	803.1
752.0	129.3	1,048.1
754.0	140.8	1,318.1
754.7	145.2	1,418.1
755.0	147.1	1,462.0

Table 19. Lake elevations and respective surface areas and volumes. Upper lake spillway elevation 763.0 feet. Lower lake spillway elevation 755.0 feet. Datum is sea level.

LOCATION MAP

Figure 19. Bathymetric map and area/volume table for Higginsville Lake near Higginsville, Missouri.